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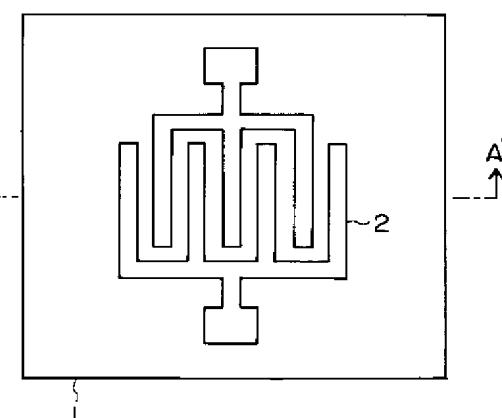
(54)【発明の名称】 ラブ波型弾性表面波デバイス

(57)【要約】

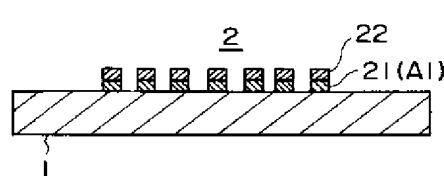
【課題】ニオブ酸リチウムまたはタンタル酸リチウムの圧電基板1上に形成されたIDT電極2によってラブ波型表面波を励起するように構成されたSAWデバイスの製造プロセスを容易にしてコストダウンを図り、IDT電極2の電気抵抗の増大による特性劣化を低減する。

【解決手段】IDT電極2を2重層構造とし、下層21を電気抵抗の低いアルミニウムで形成し、上層22を金(Au)に代えて価格の安い単金属のタンタル、タングステン又はパラジウムで形成したことを特徴とする。

(a)



(b)



【特許請求の範囲】

【請求項1】回転Yカット-X伝搬 L_iNbO_3 圧電基板の表面上にラブ波型弾性表面波を励振するようにすだれ状電極、またはすだれ状電極と反射器電極とが配設されたラブ波型弾性表面波デバイスにおいて、

前記電極は上下に積層された2層構造を有し、該2層構造の下層として前記基板上に接して形成された第1層は所定の膜厚のアルミニウムで形成され、その上に積層された第2層は所定の膜厚のタンタル、タングステンまたはパラジウムのいずれかで形成されたことを特徴とするラブ波型弾性表面波デバイス。

【請求項2】Y軸を法線としY-Z平面上でY軸から回転角が-10°乃至+50°の範囲の所定の角度で切断された回転Yカット L_iTaO_3 圧電基板の表面上にラブ波型弾性表面波を励振するようにすだれ状電極、またはすだれ状電極と反射器電極とが配設されたラブ波型弾性表面波デバイスにおいて、

前記電極は上下に積層された2層構造を有し、該2層構造の下層として前記基板上に接して形成された第1層は所定の膜厚のアルミニウムで形成され、その上に積層された第2層は所定の膜厚のタンタル、タングステンまたはパラジウムのいずれかで形成されたことを特徴とするラブ波型弾性表面波デバイス。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、 L_iNbO_3 （ニオブ酸リチウム）又は L_iTaO_3 （タンタル酸リチウム）の圧電単結晶基板を用い、ラブ波型表面波を利用した弾性表面波（Surface Acoustic Wave：以下SAWと略記する）デバイスに関するものである。

【0002】

【従来の技術】最初に L_iNbO_3 基板を用いたSAWデバイスについて述べる。Yカット-X伝搬 L_iNbO_3 基板を用いたラブ波型SAWは、電気機械結合係数 k^2 がレイリー波型のSAWに比べ格段に大きいため、広帯域な特性が求められる共振子等に応用されている。

【0003】 L_iNbO_3 基板上に、質量が大きく表面波速度が基板より遅い金（Au）の薄膜を付着させることにより、伝搬減衰の大きい擬似弾性表面波を減衰のないラブ波型のSAWに変えることができる。すなわち、圧電基板上に存在する擬似弾性表面波を、質量が大きく音速の遅い金（Au）の薄膜を付着させることにより擬似弾性表面波の音速を低下させ、該基板の遅い横波（4079m/s）より遅くすることで減衰のないラブ波型SAWにすることができる。付着させる金の薄膜は圧電基板上の全面に設ける必要はなく、SAWを励振するためのすだれ状電極（IDT電極）のみでもラブ波型のSAWデバイスが形成される。

【0004】ラブ波型SAWデバイスの代表例として、SAW共振子について以下説明する。図2（a）は、最

も単純な従来のラブ波型SAW共振子の例を示した平面図であり、圧電基板1上にIDT電極2のみが設けられた構成である。図2（b）は図2（a）のA-A'切断部端面図であり、IDT電極2の構成を示している。図2ではIDT電極の対数を3対としているが、これは3対に限る必要はないことは言うまでもない。また、図2は説明を簡単にするために、IDT電極2のみが基板上に設けられたSAWデバイスの例をあげたが、IDT電極2の両側に反射器を配設した構成としてもよい。

【0005】IDT電極2の材質としては、金（Au）が用いられることが一般的であるが、金は圧電基板1との密着性が悪いため、図2（b）に示したように、通常Crなどの接着層23が下地として付けられ、その上に金（Au）24が付けられている。しかし、金は高価であるため、原価的にSAWデバイスのコストがアップするという問題がある。

【0006】そこで、金のような貴金属の代わりに、Ta（タンタル）、W（タングステン）、Pd（パラジウム）のような比較的安価で比重の大きい卑金属を用いることでラブ波型の表面波が得られるように構成したものがある。

【0007】次に、 L_iTaO_3 基板を用いたSAWデバイスについて述べる。従来、 L_iTaO_3 基板を用いたラブ波型SAWデバイスには、本発明者らが先に提案したものがある（特願平4-57231号参照）。

【0008】図3（A）は、 L_iTaO_3 基板の回転角θに対する表面波速度（位相速度）の特性図であり、同図（B）に示すように、横軸はY-Z平面内のY軸からの切断回転角θを示し、表面波はX軸方向に伝搬する。

【0009】図3に示すように、回転Yカット L_iTaO_3 圧電基板上には、破線で示したレイリー波と、実線で示した擬似弾性表面波（リーキー波）が存在することが知られている。

【0010】また、同図に遅い横波（3380m/s）を示しているが、擬似弾性表面波のように、表面波速度がこの遅い横波よりも速い場合は、伝搬しながらエネルギーをバルク波に変換しながら伝搬するいわゆるリーキー波であるため、36°回転Y板を除いては、実用的ではない。また、レイリー波のように、表面波速度がこの遅い横波より遅い場合は、伝搬減衰のない表面波である。

【0011】 L_iTaO_3 圧電基板上に、音速の遅い重い物質を所定の膜厚で付着させて表面波速度を低下させ、遅い横波よりも遅くすることにより、擬似弾性表面波（リーキー波）を伝搬減衰のないラブ波型表面波にすることができる。

【0012】図4は、切断角θ=0°の時で、音速の遅い重い物質として金（Au）を圧電基板上に一様に付着した場合の膜厚と表面波速度との関係を計算した結果である。図4からわかるように、表面波速度は、Au膜厚（Ha/λ）を0.04（λ：表面波の波長）以上にす

れば 3380 m/s 以下となり、ラブ波型の表面波が得られることがわかる。

【0013】また、圧電基板上に一様な音速の遅い重い物質を付着させる代わりに、表面波を励振させるすだれ状電極（IDT：Interdigital Transducer）に金（Au），銀（Ag），白金（Pt）等の比重の重い貴金属を用い、所定の膜厚以上の厚さにすることで同様な効果が得られることが知られている。

【0014】さらに、図3からわかるように、回転Yカットの切断角度の範囲が -10° ～ $+50^\circ$ の範囲であれば、 36° 回転Yカット-X伝搬 LiTaO_3 と同等、もしくはそれ以上の電気機械結合係数 k^2 が得られる。この電気機械結合係数 k^2 は図3のopen（基板表面が電気的に開放）とshort（基板表面が電気的に短絡）の音速の差に比例する。

【0015】電極としては、金（Au）が用いられることが一般的であるが、金は圧電基板との密着性が悪いため、図2（b）に示したように、通常Crなどの接着層23が下地として付けられ、その上に金（Au）24が付けられている。しかし、金は高価であるため、原価的にSAW共振子のコストがアップするという問題がある。

【0016】そこで、金のような貴金属の代わりに、Ta（タンタル），W（タングステン），Pd（パラジウム）のような比較的安価で比重の大きい卑金属を用いることでラブ波型の表面波が得られるように構成されたものがある。

【0017】

【発明が解決しようとする課題】しかしながら、前述の LiNbO_3 の場合も、上記の LiTaO_3 の場合も、卑金属のみを用いてID電極を構成した場合、これらの電気抵抗（体積抵抗率： Ωm ）が、金の 2.4×10^{-8} に対して、Ta： 1.5×10^{-8} 、W： 5.5×10^{-8} 、Pd： 10.8×10^{-8} といずれも金の約2倍～6倍あるため、例えば、共振子ではQの低下、フィルタでは挿入損失の増大などの不具合が生ずる欠点がある。また、Auの密度は、 19.3 g/cm^3 と大きく、デバイスの特性は膜厚依存が大きいため、電極パターン形成時ににおいて、ライン幅及び膜厚のコントロールが厳しく要求され、製造プロセス上の難しさがあった。

【0018】本発明の目的は、従来技術の問題点の金によるコスト高、および電極がTa，WまたはPdのみの場合の電気抵抗の増大による特性劣化を低減させ、且つ、製造プロセスを容易にした LiNbO_3 基板または LiTaO_3 基板を用いたラブ波型弾性表面波デバイスを提供することにある。

【0019】

【課題を解決するための手段】本発明の請求項1記載のラブ波型弾性表面波デバイスは、回転Yカット-X伝搬 LiNbO_3 圧電基板の表面上にラブ波型弾性表面波を

励振するようにすだれ状電極、またはすだれ状電極と反射器電極とが配設されたラブ波型弾性表面波デバイスにおいて、前記電極は上下に積層された2層構造を有し、該2層構造の下層として前記基板上に接して形成された第1層は所定の膜厚のアルミニウムで形成され、その上に積層された第2層は所定の膜厚のタンタル、タングステンまたはパラジウムのいずれかで形成されたことを特徴としている。

【0020】また、本発明の請求項2記載のラブ波型弾性表面波デバイスは、Y軸を法線としY-Z平面上でY軸から回転角が -10° 乃至 $+50^\circ$ の範囲の所定の角度で切断された回転Yカット LiTaO_3 圧電基板の表面上にラブ波型弾性表面波を励振するようにすだれ状電極、またはすだれ状電極と反射器電極とが配設されたラブ波型弾性表面波デバイスにおいて、前記電極は上下に積層された2層構造を有し、該2層構造の下層として前記基板上に接して形成された第1層は所定の膜厚のアルミニウムで形成され、その上に積層された第2層は所定の膜厚のタンタル、タングステンまたはパラジウムのいずれかで形成されたことを特徴としている。

【0021】

【発明の実施の形態】以下、図面を用いて詳細に説明する。図1は本発明の実施例を示す平面図（a）とそのA-A'切断部端面図（b）である。図のIDTの対数は3対であるが、IDTの対数に関わらず、反射器があつてもその電極に対しても共通であることは言うまでもない。

【0022】請求項1記載の本発明の実施例では、回転Yカット-X伝搬 LiNbO_3 圧電基板1上に、A1の第1層IDT電極21が形成され、その上に、Ta，WもしくはPdの第2層のIDT電極22が所定の膜厚で形成されている。

【0023】また、請求項2に記載の本発明の実施例では、 -10° 乃至 $+50^\circ$ 回転Yカット LiTaO_3 圧電基板1上に、A1の第1層IDT電極21が形成され、その上にTa，WもしくはPdの第2層のIDT電極22が所定の膜厚で形成されている。

【0024】上記請求項1及び2の発明は、いずれもIDT電極2を2層とし、アルミニウムの下層は電気抵抗を下げる機能を果たし、Ta，WまたはPdで形成された上の層は、ラブ波化するための層であり、後述するように金に比較して膜厚コントロールが容易であるという特徴を有している。

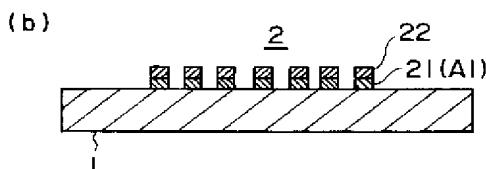
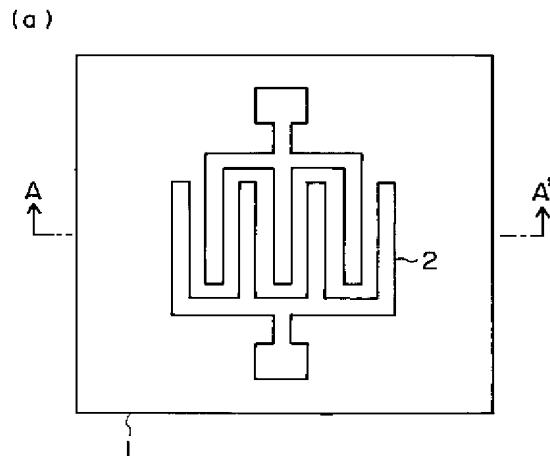
【0025】第1層21のA1の密度は 2.96 g/cm^3 であり、Au，Ta，W，Pdの密度は、それぞれ、 19.3 ， 16.6 ， 19.1 ， 12.16 である。圧電基板1上に存在する伝搬減衰のある擬似弾性表面波を、伝搬減衰のないラブ波型の表面波にするには、所定の質量が必要となる。A1の密度はAuのそれに比較して約 $1/6$ であるので、A1層21だけでラブ波化

しようとするとAuの6倍の膜厚が必要となり、プロセス的に無理があるため、実質的にラブ波化に寄与するのはTa, W又はPdの第2層22である。従って、A1層21はあまりラブ波化には寄与しないため比較的厚く付着させることができると。

【0026】また、A1の電気抵抗(体積抵抗率 $\Omega \cdot m$)は 2.75×10^{-8} であり、金の 2.4×10^{-8} とあまり変わらず、Ta, W, Pdの体積抵抗率はそれぞれ 15×10^{-8} 、 5.5×10^{-8} 、 10.8×10^{-8} であるため、Ta, W, PdのみでIDT電極を構成した場合に比べ、IDT電極2の電気抵抗を低くすることができる。

【0027】さらに、前述の如く、Ta, W, Pdの密度は、Auの密度に比較して、いずれも小さいため、ラブ波化においてAuと同等の効果を得るために、ライン幅が同じ場合、密度に逆比例した膜厚を設定しなければならないが、デバイス特性の膜厚依存の観点からは、Auに比べて依存性は小さくなるため、従来のAuほどのような厳しい膜厚コントロールは要求されない。さらに、ラブ波化においては電極の全質量が関係するため、ライン幅の視点からは、密度が小さくなった分だけAuに比べコントロール精度がゆるくなる。また、Auにくらべ、Ta, W, Pdの価格は格段に安いので、SAW共振子としてのコストを下げることができる。

【図1】



【0028】

【発明の効果】以上詳細に述べたように、本発明を実施することにより、IDT電極として、従来のAu電極を用いた場合に比べて材料費が格段に安くなり、Ta, WまたはPdのみのときの電気抵抗増大によるデバイスの特性劣化も抑えられ、且つ、製造プロセスが容易になるため、実用上の効果は極めて大きい。

【図面の簡単な説明】

【図1】本発明の実施例を示す平面図とそのAA'切断部端面図である。

【図2】従来のSAWデバイスの平面図とそのAA'切断部端面図である。

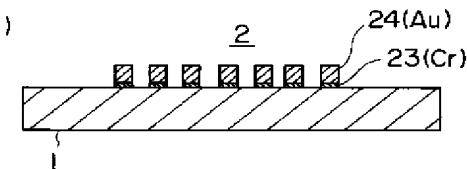
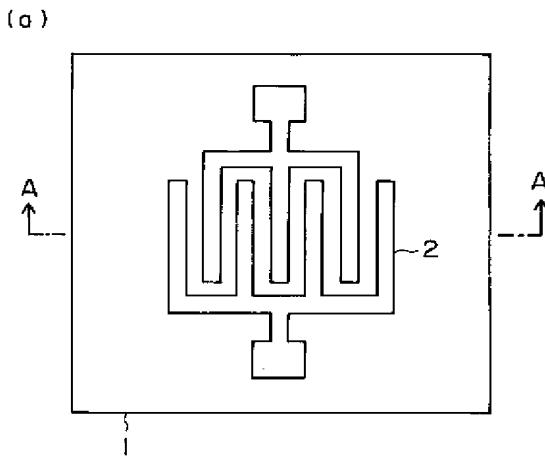
【図3】回転YカットLiTaO₃基板における回転角と表面波速度の関係図である。

【図4】回転Y板LiTaO₃基板における表面波速度の膜厚依存性を示す説明図である。

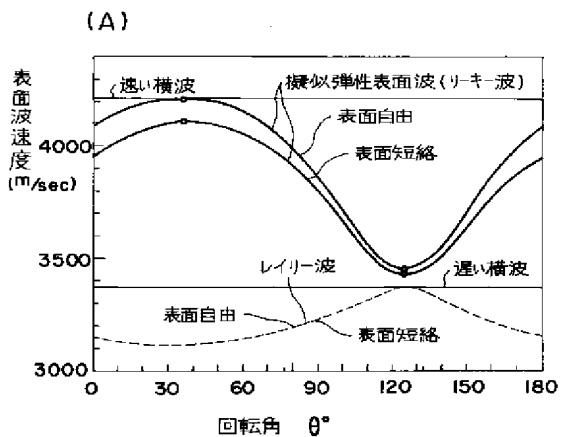
【符号の説明】

- 1 圧電基板
- 2 IDT電極
- 21 IDT電極の第1層
- 22 IDT電極の第2層
- 23 接着層(Cr)
- 24 IDT電極(Au)

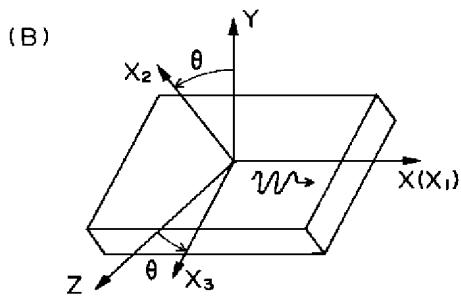
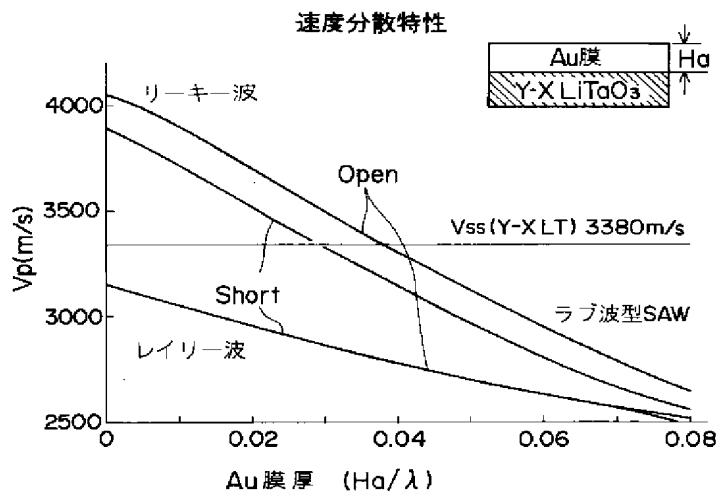
【図2】



【図3】



【図4】



PATENT ABSTRACTS OF JAPAN

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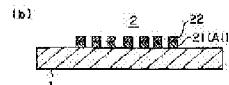
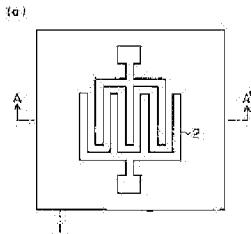
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(21) Application number : 09-061731 (71) Applicant : KOKUSAI ELECTRIC CO LTD

(22) Date of filing : 03. 03. 1997 (72) Inventor : KANDA TADASHI

(54) LOVE WAVE-TYPE SURFACE ACOUSTIC WAVE DEVICE



(57) Abstract:

PROBLEM TO BE SOLVED: To reduce cost by providing a Love wave-type surface acoustic wave by using a comparatively inexpensive base metal with large specific gravity, such as Ta(tantalum), W(tungsten) and Pd(palladium), instead of noble metal such as gold.

SOLUTION: An interdigital electrode(IDT electrode) 21 of a first layer made of Al(aluminum) is formed on a rotary Y cut-X transmission LiNbO₃ piezoelectric substrate 1. Then, an IDT electrode 22 of a second layer formed of Ta, W or Pd is formed on the electrode with a prescribed film thickness. The IDT electrode 21 of the first layer of Al is formed on -10° to +50° rotary Y cut LiTaO₃ piezoelectric substrate 1, and the IDT electrode 22 of the second layer of Ta, W or PD is formed on the electrode with a prescribed thickness. The both IDT electrodes are made into two layers. The layer below aluminum is a layer, where electric

resistance is lowered and the upper layer formed of Ta, W or Pd is the layer formed making the Love-wave and it can control the film thickness more easily as compared to gold.

LEGAL STATUS

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CLAIMS

[Claim(s)]

[Claim 1] Rotation Y cut-X propagation LiNbO₃ In the Love wave mold surface acoustic wave device with which the blind-like electrode or the blind-like electrode, and the reflector electrode were arranged so that a Love wave mold surface acoustic wave might be excited on the front face of a piezo-electric substrate Said electrode has the two-layer structure by which the laminating was carried out up and down, and it is

formed with the aluminum of thickness predetermined [1st layer] formed in contact with said substrate top as a lower layer of this two-layer structure. It is the Love wave mold surface acoustic wave device characterized by being formed by either the tantalum of the thickness predetermined [2nd layer] with which the laminating was carried out on it, the tungsten or palladium.

[Claim 2] Rotation Y cut LiTa03 from which the Y-axis was made into the normal and the angle of rotation was cut from the Y-axis on the Y-Z flat surface at an angle of predetermined [of the range which is -10 degrees thru/or +50 degrees] So that a Love wave mold surface acoustic wave may be excited on the front face of a piezo-electric substrate Blind-like electrode, Or it sets to the Love wave mold surface acoustic wave device with which the blind-like electrode and the reflector electrode were arranged. Said electrode has the two-layer structure by which the laminating was carried out up and down, and it is formed with the aluminum of thickness predetermined [1st layer] formed in contact with said substrate top as a lower layer of this two-layer structure. It is the Love wave mold surface acoustic wave device characterized by being formed by either the tantalum of the thickness predetermined [2nd layer] with which the laminating was carried out on it, the tungsten or palladium.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the surface acoustic wave (Surface Acoustic Wave : outline Following SAW) device using a Love wave mold surface wave using LiNb03 or (lithium niobate) the piezo-

electric single crystal substrate of LiTaO₃ (lithium tantalate).

[0002]

[Description of the Prior Art] It is LiNbO₃ to the beginning. The SAW device using a substrate is described. Y cut-X propagation LiNbO₃ the Love wave mold SAW using a substrate -- electromechanical coupling coefficient k² Compared with SAW of a Rayleigh wave mold, it is markedly alike, and since it is large, it is applied to the resonator asked for a broadband property.

[0003] LiNbO₃ The large false surface acoustic wave of propagation attenuation is changeable into SAW of a Love wave mold without attenuation by making the thin film of gold (Au) with a surface wave rate slower than a substrate with large mass adhere on a substrate. That is, when mass makes the thin film of the late large gold (Au) of acoustic velocity the false surface acoustic wave which exists on a piezo-electric substrate adhere, the acoustic velocity of a false surface acoustic wave can be reduced, and it can be made the Love wave mold SAW without attenuation by making it later than a transverse wave with this late substrate (4079 m/s). It is not necessary to prepare the thin film of the gold made to adhere the whole surface on a piezo-electric substrate, and the SAW device of the blind-like electrode (IDT electrode) Love wave mold for exciting SAW is formed.

[0004] As an example of representation of a Love wave mold SAW device, a SAW resonator is explained below. Drawing 2 (a) is the top view having shown the example of the simplest conventional Love wave mold SAW resonator, and is the configuration that only the IDT electrode 2 was formed on the piezo-electric substrate 1. Drawing 2 (b) is the A-A' end view of the sectioned part of drawing 2 (a), and shows the configuration of the IDT electrode 2. Although the logarithm of an IDT electrode is made into three pairs in drawing 2 , it cannot be overemphasized that it is not necessary to restrict this to three pairs. Moreover, drawing 2 is good also as a configuration which arranged the reflector in the both sides of the IDT electrode 2, although only the IDT electrode 2 gave the example of a SAW device established on the substrate in order to simplify explanation.

[0005] Although it is common as the quality of the material of the IDT electrode 2 that gold (Au) is used, since adhesion of gold with the piezo-electric substrate 1 is bad, as shown in drawing 2 (b), the glue lines 23, such as Cr, are usually attached as a substrate, and gold (Au) 24 is attached on it. However, since gold is expensive, it has the problem that the cost of a SAW device rises in cost price.

[0006] Then, instead of noble metals like gold, it is comparatively

cheap and there are some which were constituted so that the surface wave of a Love wave mold might be acquired by thing like Ta (tantalum), W (tungsten), and Pd (palladium) for which base metal with large specific gravity is used.

[0007] Next, LiTa03 The SAW device using a substrate is described. The former and LiTa03 There are some which this invention persons proposed previously in the Love wave mold SAW device using a substrate (refer to Japanese Patent Application No. No. 57231 [four to]).

[0008] Drawing 3 (A) is LiTa03. It is the property Fig. of a surface wave rate (phase velocity) to the angle of rotation theta of a substrate, and as shown in this drawing (B), an axis of abscissa shows the cutting angle of rotation theta from the Y-axis within a Y-Z flat surface, and a surface wave is spread to X shaft orientations.

[0009] As shown in drawing 3 , it is the rotation Y cut LiTa03. It is known that the Rayleigh wave shown with the broken line and the false surface acoustic wave (Leakey wave) shown as the continuous line exist on a piezo-electric substrate.

[0010] Moreover, although the late transverse wave (3380m/(s)) is shown in this drawing, it is not practical, if 36-degree rotation Y cut is removed like a false surface acoustic wave since it is the so-called Leakey wave spread while changing energy into a bulk wave, spreading when a surface-wave rate is quicker than this late transverse wave. Moreover, like a Rayleigh wave, when a surface wave rate is slower than this late transverse wave, it is a surface wave without propagation attenuation.

[0011] LiTa03 A false surface acoustic wave (Leakey wave) can be made into a Love wave mold surface wave without propagation attenuation by making the late heavy matter of acoustic velocity adhere in predetermined thickness, reducing a surface wave rate on a piezo-electric substrate, and making it later than a late transverse wave.

[0012] Drawing 4 is the result of calculating the relation between the thickness at the time of adhering gold (Au) uniformly on a piezo-electric substrate as late heavy matter of acoustic velocity, and a surface wave rate in the time of theta= 0 degree of cutting angles. As drawing 4 shows, it turns out that a surface wave rate will become 3380 or less m/s if Au thickness (Ha/lambda) is carried out more than 0.04 (lambda: wavelength of a surface wave), and the surface wave of a Love wave mold is acquired.

[0013] Moreover, instead of making the late heavy matter of uniform acoustic velocity adhere on a piezo-electric substrate, noble metals with the heavy specific gravity of gold (Au), silver (Ag), platinum (Pt),

etc. are used for the blind-like electrode (IDT:Interdigital Transducer) which excites a surface wave, and it is known that the same effectiveness will be acquired by making it the thickness more than predetermined thickness.

[0014] Furthermore, if the range of the cutting include angle of a rotation Y cut is range which is -10 degrees - +50 degrees as drawing 3 shows, it is the 36-degree rotation Y cut-X propagation LiTa03.

Equivalent or electromechanical coupling coefficient k₂ beyond it It is obtained. This electromechanical coupling coefficient k₂ is proportional to the difference of open (a substrate front face opens electrically) of drawing 3 , and the acoustic velocity of short (a substrate front face is a short circuit electrically).

[0015] Although it is common as an electrode that gold (Au) is used, since adhesion of gold with a piezo-electric substrate is bad, as shown in drawing 2 (b), the glue lines 23, such as Cr, are usually attached as a substrate, and gold (Au) 24 is attached on it. However, since gold is expensive, it has the problem that the cost of a SAW resonator rises in cost price.

[0016] Then, instead of noble metals like gold, it is comparatively cheap and there are some which were constituted so that the surface wave of a Love wave mold might be acquired by thing like Ta (tantalum), W (tungsten), and Pd (palladium) for which base metal with large specific gravity is used.

[0017]

[Problem(s) to be Solved by the Invention] However, the above-mentioned LiNb03 A case is also above LiTa03. When a case also constitutes ID electrode only using base metal, these electric resistance (volume resistivity: omegam) receives 2.4x10⁻⁸ of gold. Ta: Since there is all twice [about] as many - [as this] 6 times gold with 15x10⁻⁸, W:5.5x10⁻⁸, and Pd:10.8x10⁻⁸, at a resonator, there is a fault which faults, such as increase of an insertion loss, produce with the fall of Q, and a filter. Moreover, the consistency of Au is 19.3 g/cm³. Since it was large and the property of a device had large thickness dependence, control of the Rhine width of face and thickness was severely required at the time of electrode pattern formation, and there was difficulty on a manufacture process.

[0018] The purpose of this invention is LiNb03 to which the cost quantity by the gold of the trouble of the conventional technique and an electrode reduced property degradation by increase of the electric resistance only in the case of Ta, W, or Pd, and made the manufacture process easy. A substrate or LiTa03 It is in offering the Love wave mold

surface acoustic wave device using a substrate.

[0019]

[Means for Solving the Problem] The Love wave mold surface acoustic wave device of this invention according to claim 1 Rotation Y cut-X propagation LiNb03 In the Love wave mold surface acoustic wave device with which the blind-like electrode or the blind-like electrode, and the reflector electrode were arranged so that a Love wave mold surface acoustic wave might be excited on the front face of a piezo-electric substrate Said electrode has the two-layer structure by which the laminating was carried out up and down, and it is formed with the aluminum of thickness predetermined [1st layer] formed in contact with said substrate top as a lower layer of this two-layer structure. It is characterized by being formed by either the tantalum of thickness predetermined [2nd layer] by which the laminating was carried out on it, the tungsten or palladium.

[0020] Moreover, the Love wave mold surface acoustic wave device of this invention according to claim 2 Rotation Y cut LiTa03 from which the Y-axis was made into the normal and the angle of rotation was cut from the Y-axis on the Y-Z flat surface at an angle of predetermined [of the range which is -10 degrees thru/or +50 degrees] So that a Love wave mold surface acoustic wave may be excited on the front face of a piezo-electric substrate Blind-like electrode, Or it sets to the Love wave mold surface acoustic wave device with which the blind-like electrode and the reflector electrode were arranged. Said electrode has the two-layer structure by which the laminating was carried out up and down, and it is formed with the aluminum of thickness predetermined [1st layer] formed in contact with said substrate top as a lower layer of this two-layer structure. It is characterized by being formed by either the tantalum of thickness predetermined [2nd layer] by which the laminating was carried out on it, the tungsten or palladium.

[0021]

[Embodiment of the Invention] Hereafter, it explains to a detail using a drawing. Drawing 1 is the top view (a) showing the example of this invention, and its A-A' end view of the sectioned part (b). Although the logarithm of IDT of drawing is three pairs, even if it is not concerned with the logarithm of IDT but there is a reflector, it cannot be overemphasized that it is common also to the electrode.

[0022] At the example of this invention according to claim 1, it is the rotation Y cut-X propagation LiNb03. On the piezo-electric substrate 1, the 1st layer IDT electrode 21 of aluminum is formed, and the IDT electrode 22 of the 2nd layer of Ta, W, or Pd is formed by predetermined

thickness on it.

[0023] Moreover, at the example of this invention according to claim 2, they are -10 degrees thru/or the +50-degree rotation Y cut LiTa03. On the piezo-electric substrate 1, the 1st layer IDT electrode 21 of aluminum is formed, and the IDT electrode 22 of the 2nd layer of Ta, W, or Pd is formed by predetermined thickness on it.

[0024] The layer after each invention of above-mentioned claims 1 and 2 made the IDT electrode 2 two-layer, and the lower layer of aluminum achieved the function which lowers electric resistance and being formed by Ta, W, or Pd is a layer for Love-wave-izing, and has the description that thickness control is easy as compared with gold so that it may mention later.

[0025] the 1st -- the consistency of aluminum of layer 21 -- 2.96 g/cm³ it is -- the consistencies of Au, Ta, W, and Pd are 19.3, 16.6, 19.1, and 12.16, respectively. Predetermined mass is needed in order to make into the surface wave of a Love wave mold without propagation attenuation a false surface acoustic wave with the propagation attenuation which exists on the piezo-electric substrate 1. contributing to Love wave-ization substantially, since the consistency of aluminum is about 1/6 as compared with it of Au and it is [6 times as much thickness as Au is needed and] impossible in process, when it is going to Love-wave-size only in the aluminum layer 21 -- the 2nd of Ta, W, or Pd -- it is layer 22. Therefore, since the aluminum layer 21 seldom contributes to Love wave-ization, it is possible to make it adhere comparatively thickly.

[0026] Moreover, the electric resistance (volume-resistivity omega-m) of aluminum is 2.75×10^{-8} , and it seldom changes to 2.4×10^{-8} of gold, but since the volume resistivities of Ta, W, and Pd are 15×10^{-8} , 5.5×10^{-8} , and 10.8×10^{-8} , respectively, they can make the electric resistance of the IDT electrode 2 low compared with the case where an IDT electrode is constituted only from Ta, W, and Pd.

[0027] Furthermore, since all are small, in order for the consistency of Ta, W, and Pd to acquire effectiveness equivalent to Au in Love-wave-izing like the above-mentioned as compared with the consistency of Au, when the Rhine width of face is the same, the thickness inversely proportional to a consistency must be set up, but since a dependency becomes small compared with Au from a viewpoint of thickness dependence of a device property, severe thickness control like [like the conventional Au] is not required. Furthermore, since the total mass of an electrode is related to Love wave-ization, control precision becomes loose [part / to which the consistency from the view of the Rhine width

of face became small / Au]. moreover, since the price of Ta, W, and Pd is alike and cheap compared with Au, the cost as a SAW resonator can be lowered.

[0028]

[Effect of the Invention] since the cost of materials is markedly alike compared with the case where the conventional Au electrode is used as an IDT electrode by carrying out this invention, it becomes cheap, and property degradation of the device by the electric resistance increase at the time only of Ta, W, or Pd is also suppressed and a manufacture process becomes easy as stated to the detail above, practical effectiveness is very large.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] They are the top view showing the example of this invention, and its AA' cutting section end-face side.

[Drawing 2] It is the conventional top view and its conventional AA' end view of the sectioned part of a SAW device.

[Drawing 3] Rotation Y cut LiTaO₃ It is the related Fig. of an angle of rotation and a surface wave rate in a substrate.

[Drawing 4] Rotation Y cut LiTaO₃ It is the explanatory view showing the thickness dependency of the surface wave rate in a substrate.

[Description of Notations]

- 1 Piezo-electric Substrate
- 2 IDT Electrode
- 21 1st Layer of IDT Electrode
- 22 2nd Layer of IDT Electrode

23 Glue Line (Cr)
24 IDT Electrode (Au)

[Translation done.]

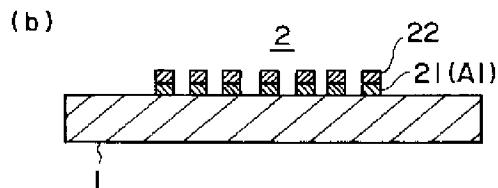
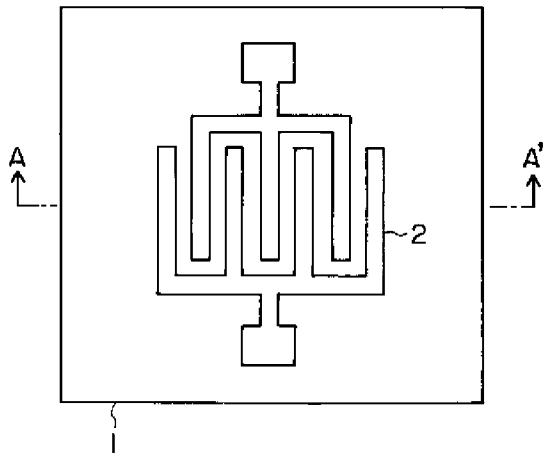
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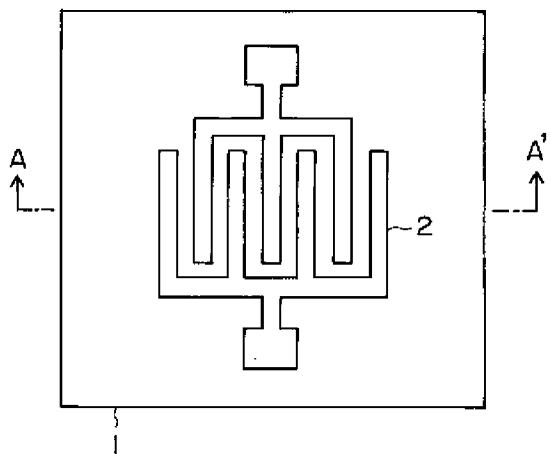
DRAWINGS

[Drawing 1]
(a)

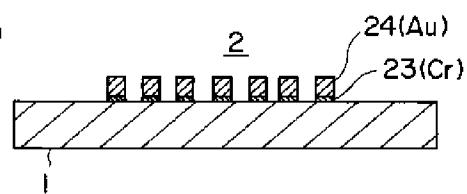


[Drawing 2]

(a)

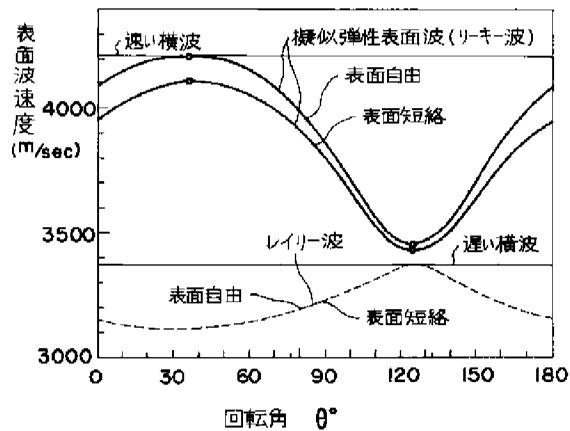


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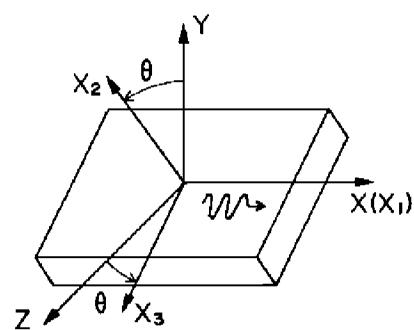


[Drawing 3]

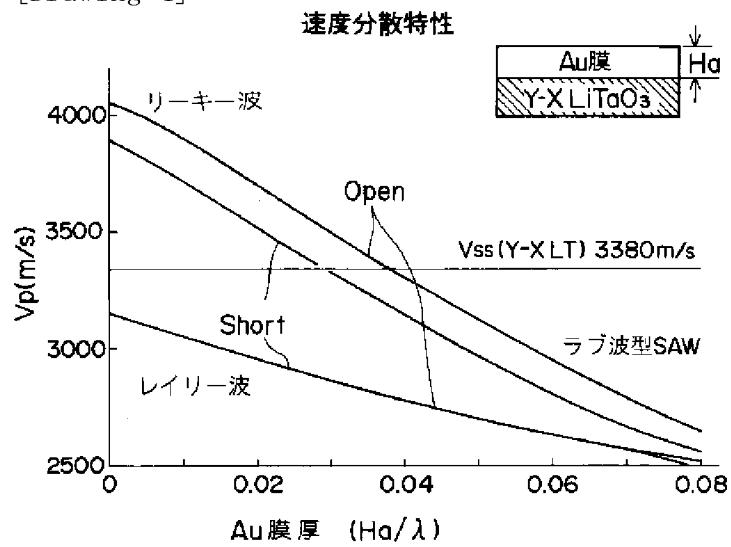
(A)



(B)



[Drawing 4]



[Translation done.]